

7.4. Project File LEW3.CPP

This file contains the major computation of the program except for the FFT and the impulse response code.

Includes:

STDIO.H - library file containing the input/output routines.

STDLIB.H - standard library file needed for exit function.

MATH.H - library file containing the math functions.

Defines:

MAXLAYERS - the maximum number of reflecting layers (or reflected rays seen by the receiver) in the ionosphere that the program will handle.

DATA - the number of real data points in the output data streams. Two successive data points represent a complex number. The first is the real part and the second is the imaginary part.

TWOPI - definition of $2\pi = 6.28318530717959$.

C - speed of light in km/ μ s, $C = 0.299792458$.

Structures:

ray_path - structure that contains all input and computed variables characteristic of a path. The elements of **ray_path** are given on p. 28.

compute - structure that contains all the variables specific to the computations or not specific to an individual path. The elements of **compute** are given on p. 29.

String type:

STRING - used for handling file names of input and output files.

Global variables:

cdat - array of **float** of size $2 \times \text{DATA}$, holds the impulse response data in the first half (up to DATA) for each layer at a particular time slice, the second half is zero padding. Later *cdat* holds the complex coefficients of the FFT for printing to the output files. This is usually a structure of real variables, but it is used in this program as a complex structure. A consecutive pair of floats in *cdat* represent a complex number, the first number of the pair (the even index) represents the real part and the second (the odd index) is the imaginary part.

- seed1* - **long integer**, random number seed for the Wichmann-Hill generator, initialized in **comp_arrays**, calculated and updated in **ran1**.
- seed2* - **long integer**, random number seed for the Wichmann-Hill generator, initialized in **comp_arrays**, calculated and updated in **ran1**.
- seed3* - **long integer**, random number seed for the Wichmann-Hill generator, initialized in **comp_arrays**, calculated and updated in **ran1**.
- seed4* - **long integer**, random number seed for L'Ecuyer's generator, initialized in **comp_arrays**, calculated and updated in **ran2**.
- seed5* - **long integer**, random number seed for L'Ecuyer's generator, initialized in **comp_arrays**, calculated and updated in **ran2**.

```

#include <stdio.h>
#include <math.h>
#include <stdlib.h>

#define MAXLAYERS 3
#define DATA 4096
#define TWOPI 6.28318530717959
#define C 0.299792458

typedef struct ray_path
{
    float path_Distance, center_freq, penetrate_freq, thick_scale, maxD_hgt;
    float peak_amplitude, sigma_tau, sigma_c, sigma_D, fds, fdl;
    double tau_c, sigma_f, slp, tau_L, tau_U, tau_l, alpha, sigma_l, lambda;
};

typedef struct compute
{
    int layers, slices, seed;
    float delta_t, afl;
    double delta_tau, big_el;
};

typedef char *STRING;

/* Global Variables */

long seed1, seed2, seed3, seed4, seed5;

float cdat[2 * DATA];

```